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Investigating the Effect of Interfacial Strength on Deformation and Failure Mechanisms in Bond Systems



C. T. Liu
AFRL/PRSM 10 E. Saturn Blvd.
Edwards AFB CA 93524-7680

Fu-Pen Chiang
Department of Mechanical Engineering
State University of New York
Stony Brook, N. Y. 11790

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Objectives:

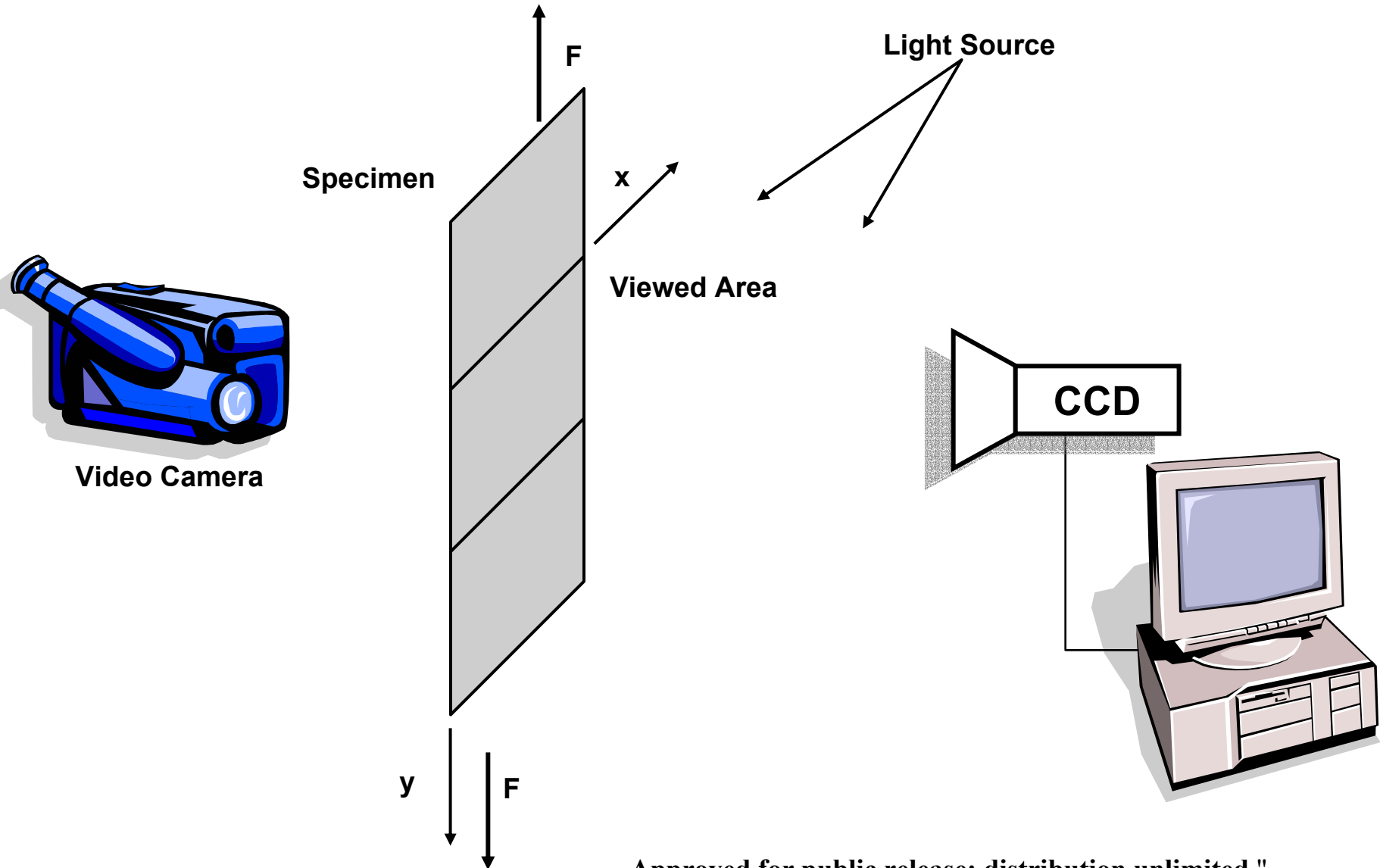


- **Investigate the Effects of Interfacial Strength on Deformation and Failure Mechanisms in Bi-Material Bonded Specimens under a 0.01 in/min Constant Displacement Rate Condition.**
- **Determine the Strain Rate Distribution in the Bi-Material Bonded Specimens.**

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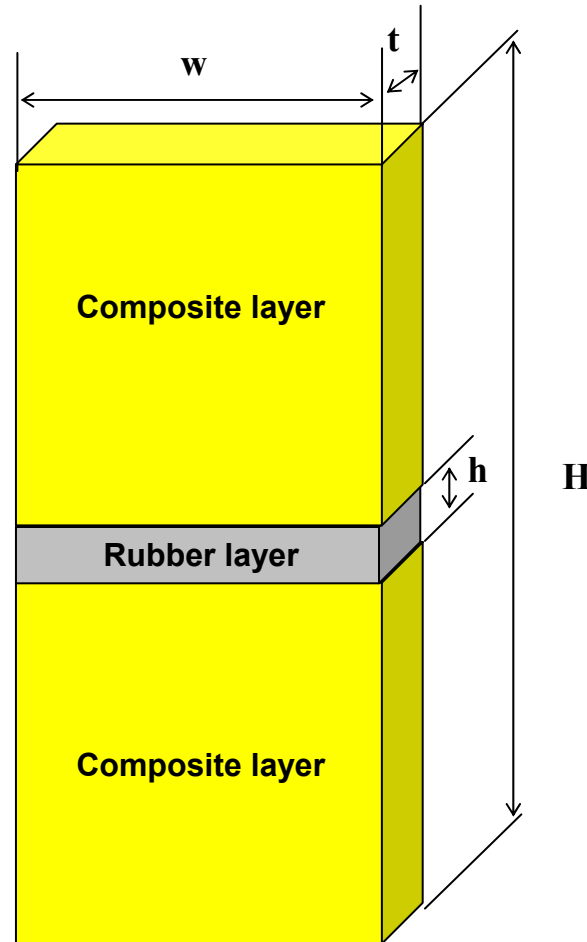


Experimental Set Up





Specimen Geometry



$$w = 0.5 \text{ in.}$$

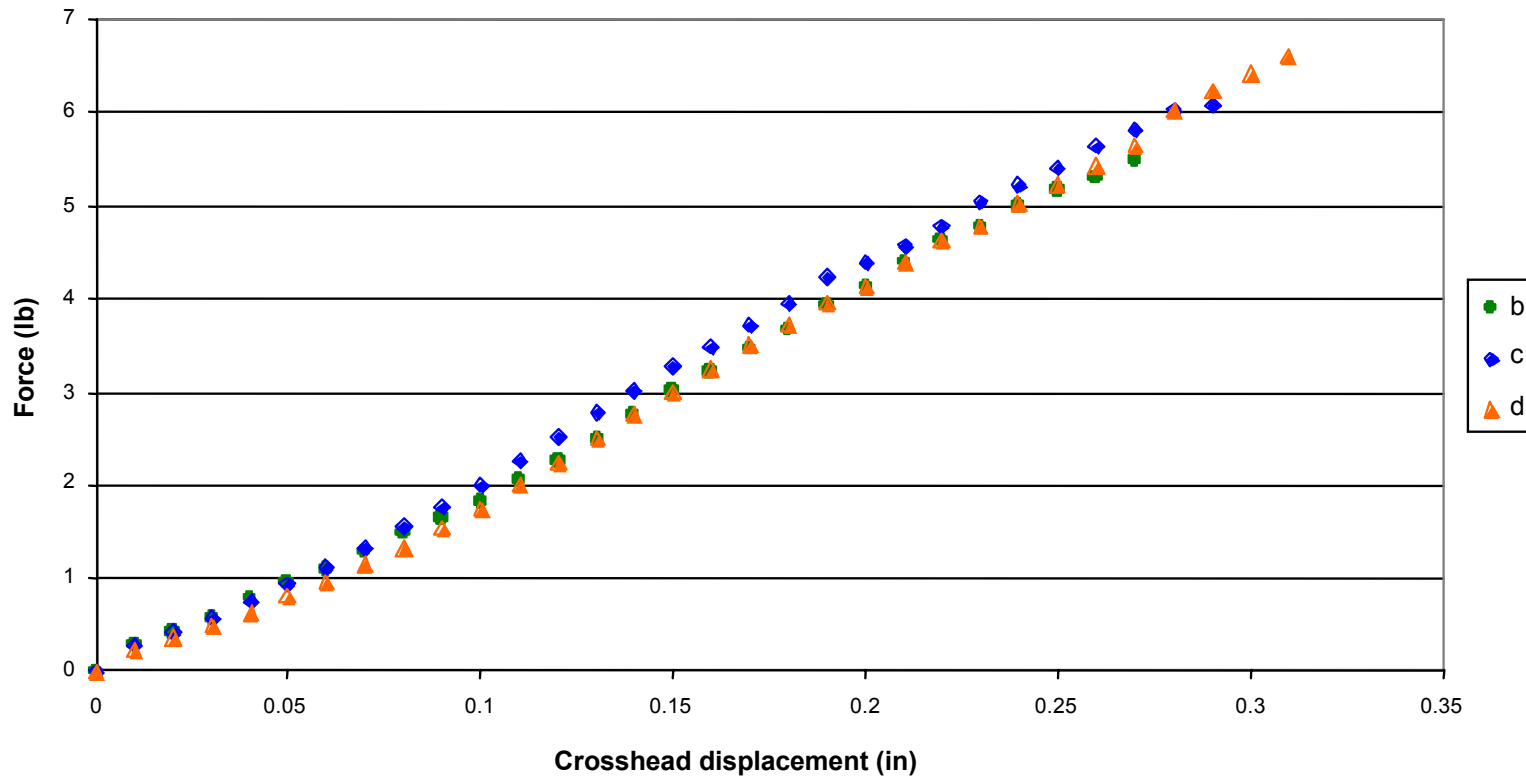
$$t = 0.2 \text{ in.}$$

$$h = 0.1 \text{ in.}$$

$$H = 4 \text{ in.}$$



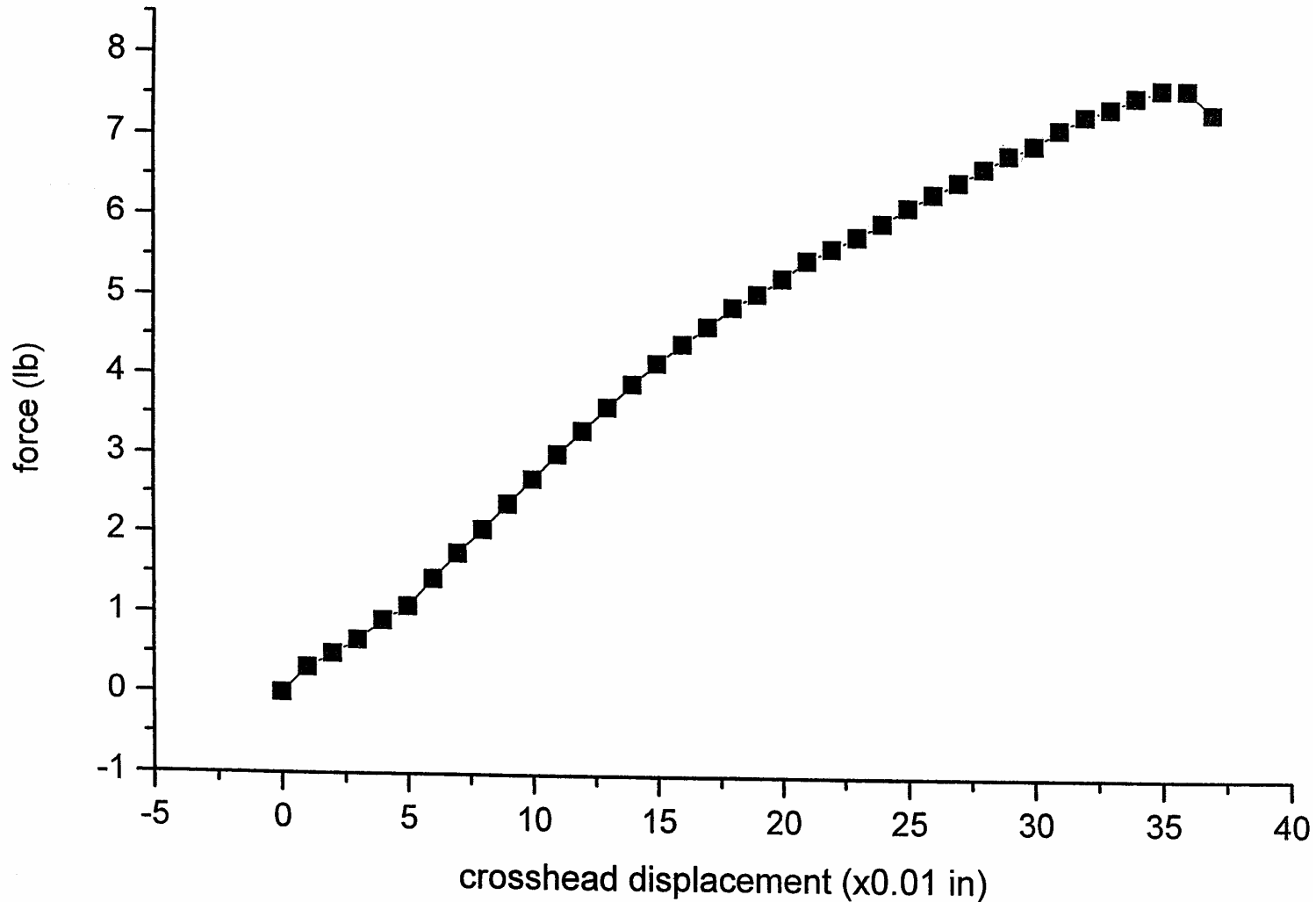
Force Versus Displacement Curves (specimen with strong interfacial strength)



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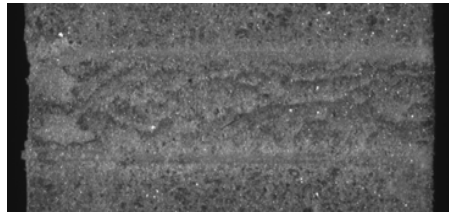
Force Versus Displacement Curves (specimen with weak interfacial strength)



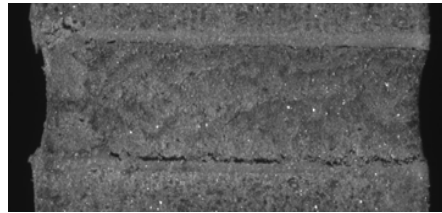
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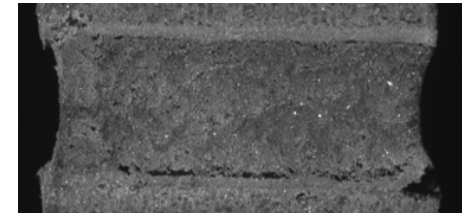
Mechanism of Debonding (specimen with strong interfacial strength)



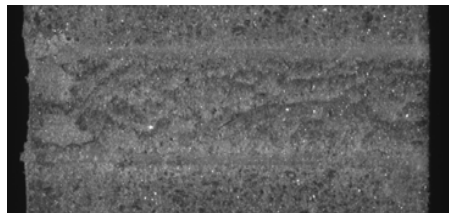
0
min



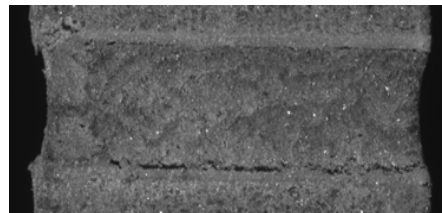
25
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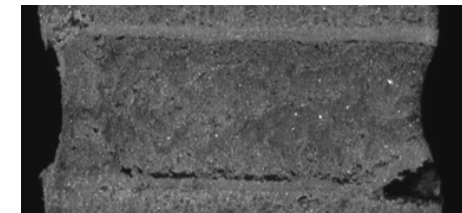
32
min



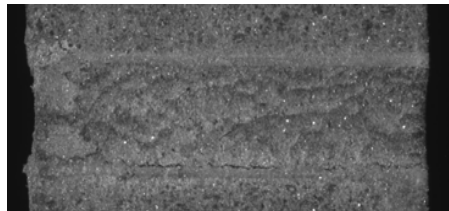
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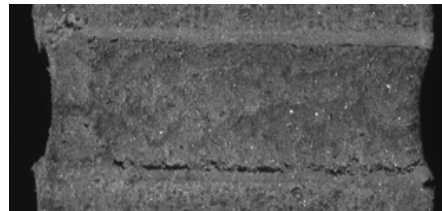
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min



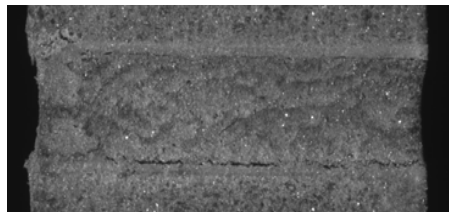
32 min
40 sec



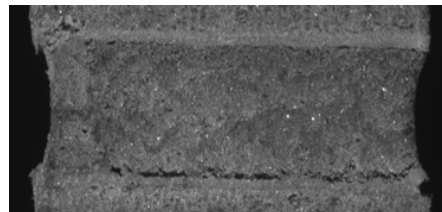
15
min



28
min



20
min



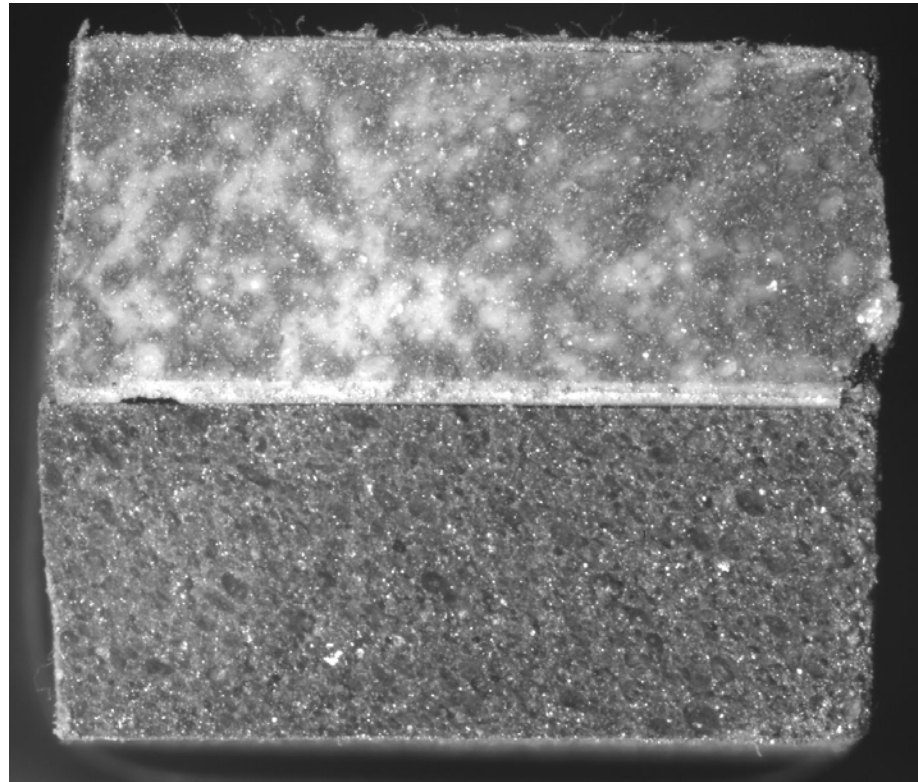
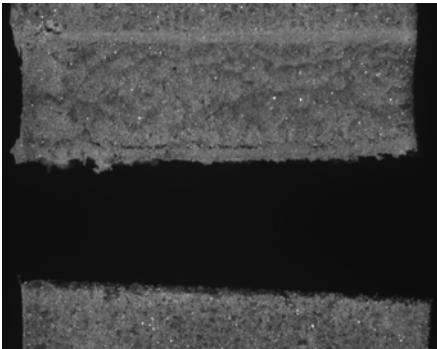
30
min

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Fracture Surfaces

(specimen with strong interfacial strength)

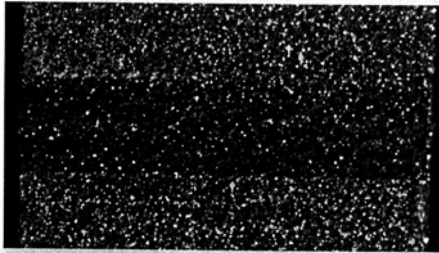


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Fracture Surfaces

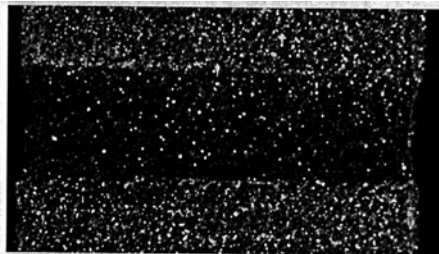
(specimen with weak interfacial strength)



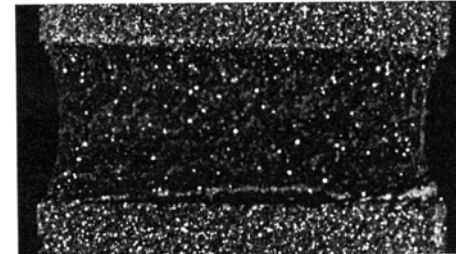
0
min



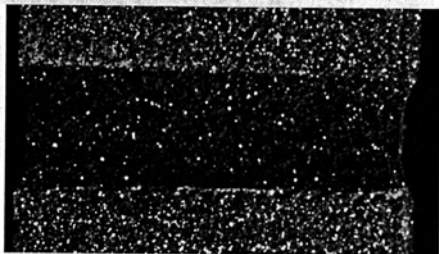
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min



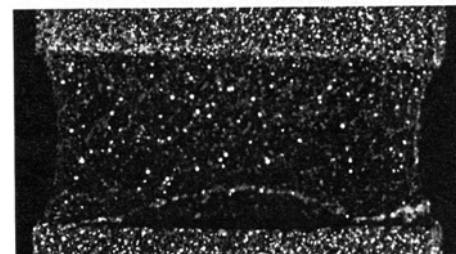
18
min



25
min



21
min

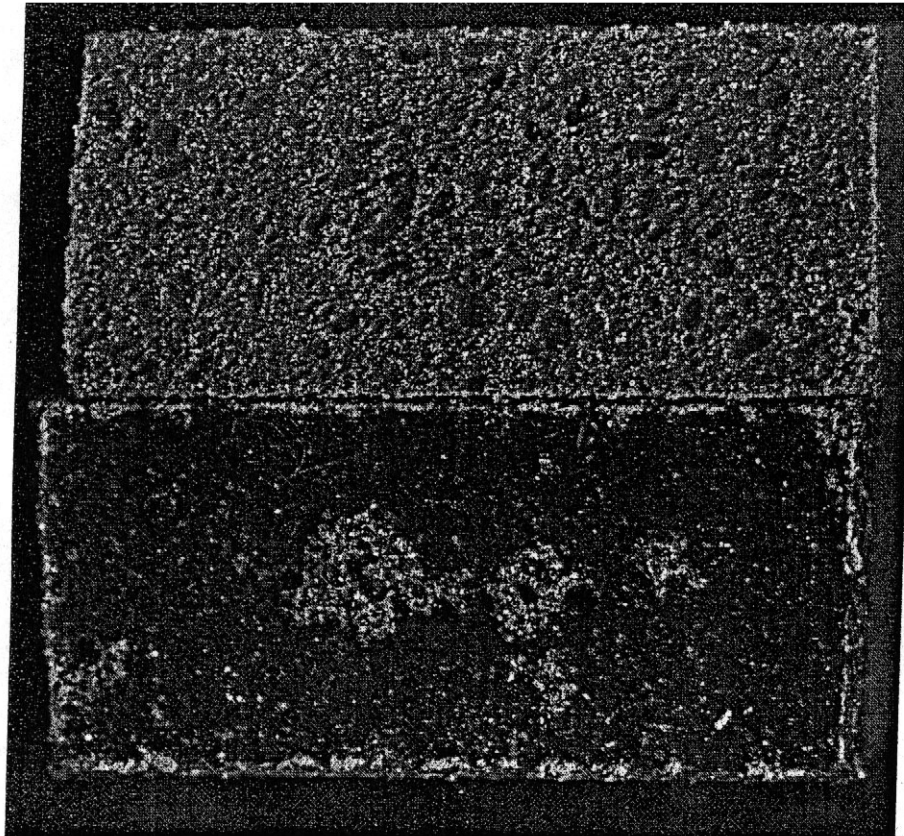


26
min



Fracture Surfaces

(specimen with weak interfacial strength)

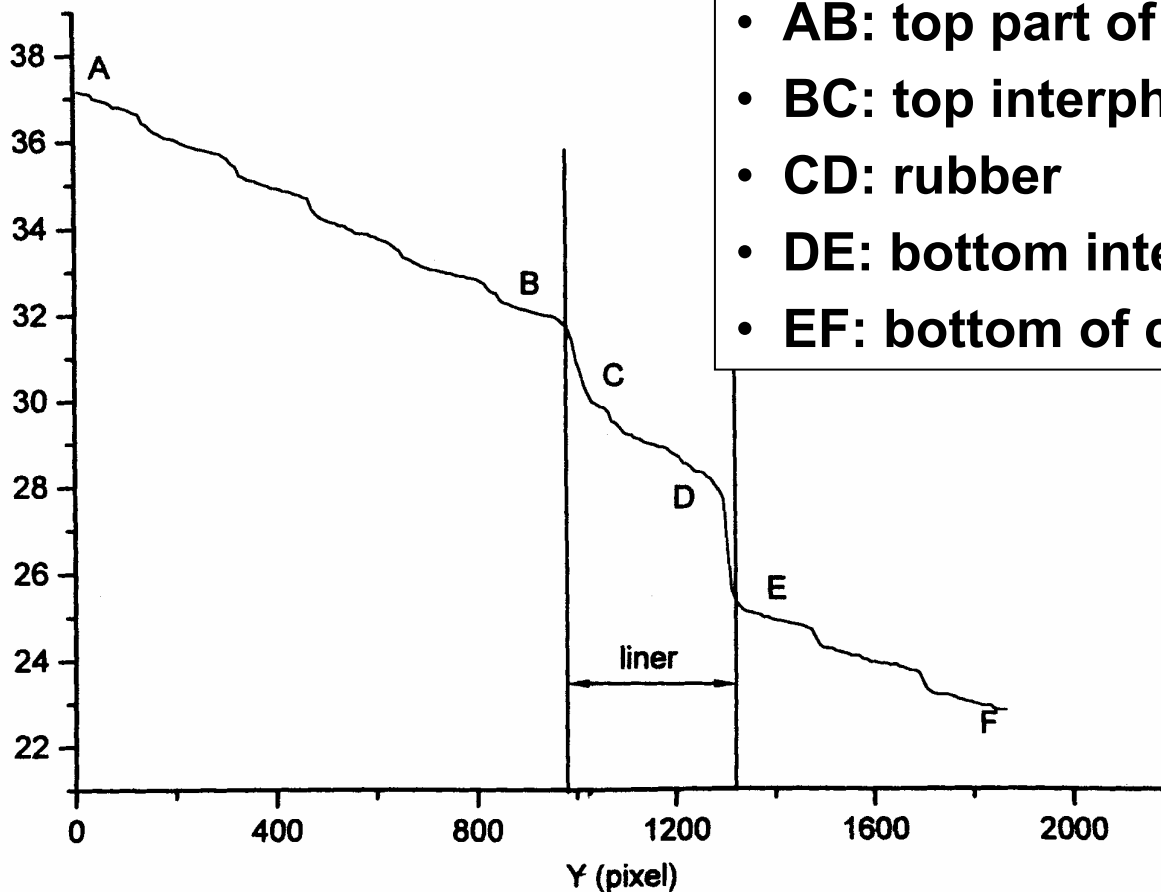


Broken Interface of Specimen V



Displacement Increments Distribution along y Direction

displacement increment between 8 and 10 min
 Δv (pixel)

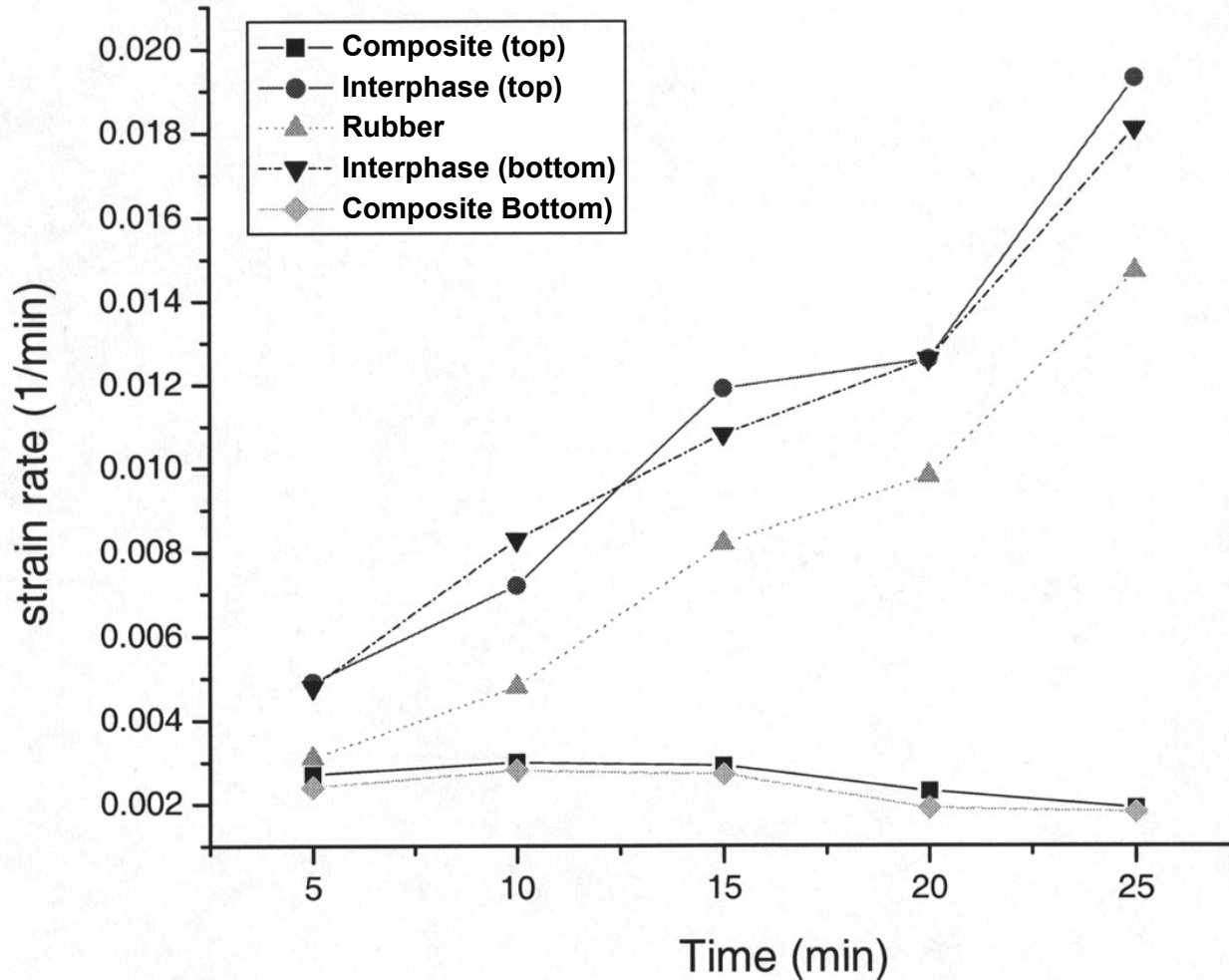


Five sections:

- AB: top part of composite
- BC: top interphase
- CD: rubber
- DE: bottom interphase
- EF: bottom of composite

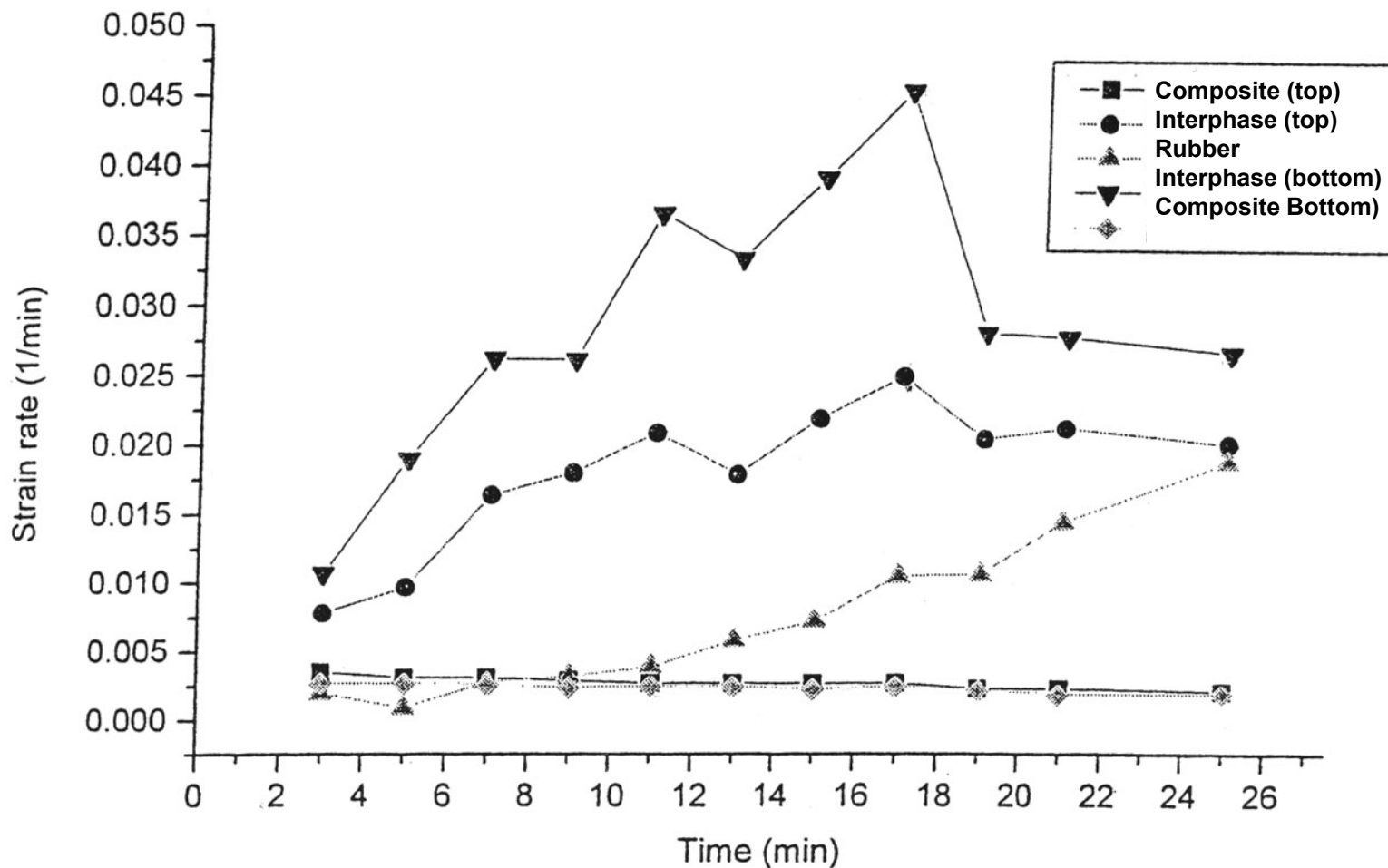


Strain Rate Versus Time Curve (specimen with strong interfacial strength)





Strain Rate Versus Time Curves (specimen with weak interfacial strength)





Conclusions:

- * For the specimen with weak interfacial strength, failure occurs in the interface.**
- For the specimen with strong interfacial strength, failure occurs in the composite layer.**
- There are interphase regions near the interfaces of the specimen.**
- The strain rates in the rubber layer, the composite layers, and the interphase regions change with time.**
- The strain rates in the interphase regions are significantly higher than that in the rubber and the composite layers.**
- The strain rates in the interphase regions decrease as the interfacial strength increases.**

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